km with reach length defined at 200 m intervals. The stage-area data for the reservoir from the ResSim model was combined with contour and spot height data from the General Scheme reports and data sets to generate estimated cross-sectional profiles for the length of the reservoir.

3.3.3   The model has been tested although more details regarding the observed flows and surveyed bathymetry would be required to improve and finalise the model.
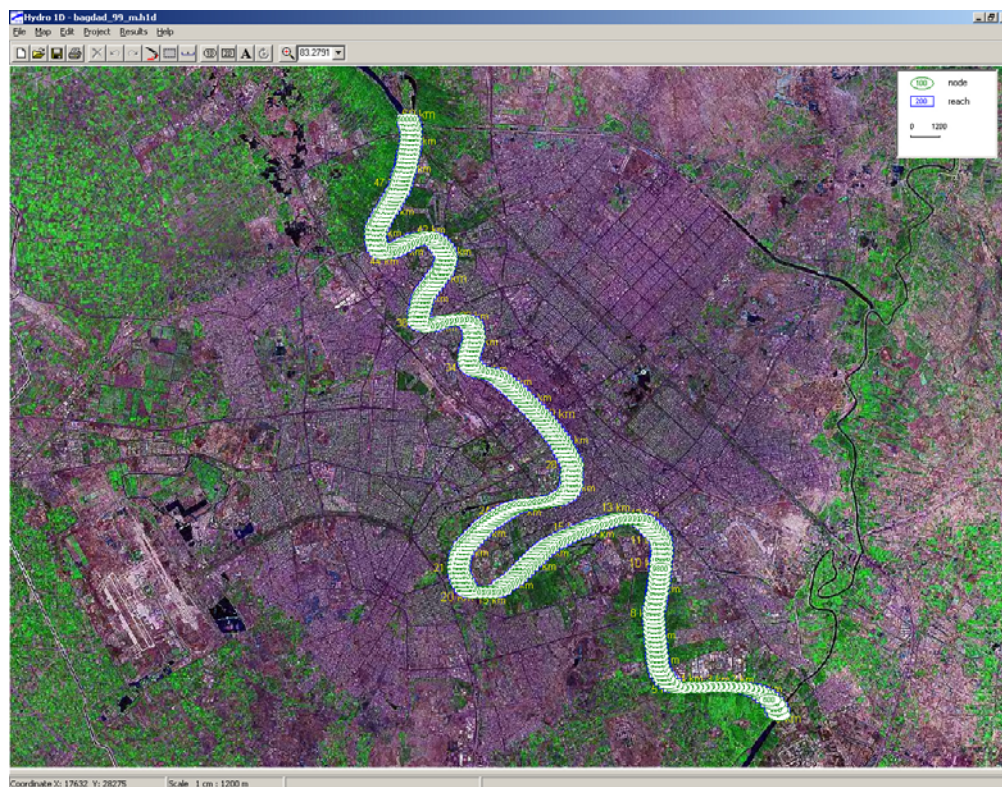
Figure 3.3: Model Network for Test Reach at Tharthar Reservoir
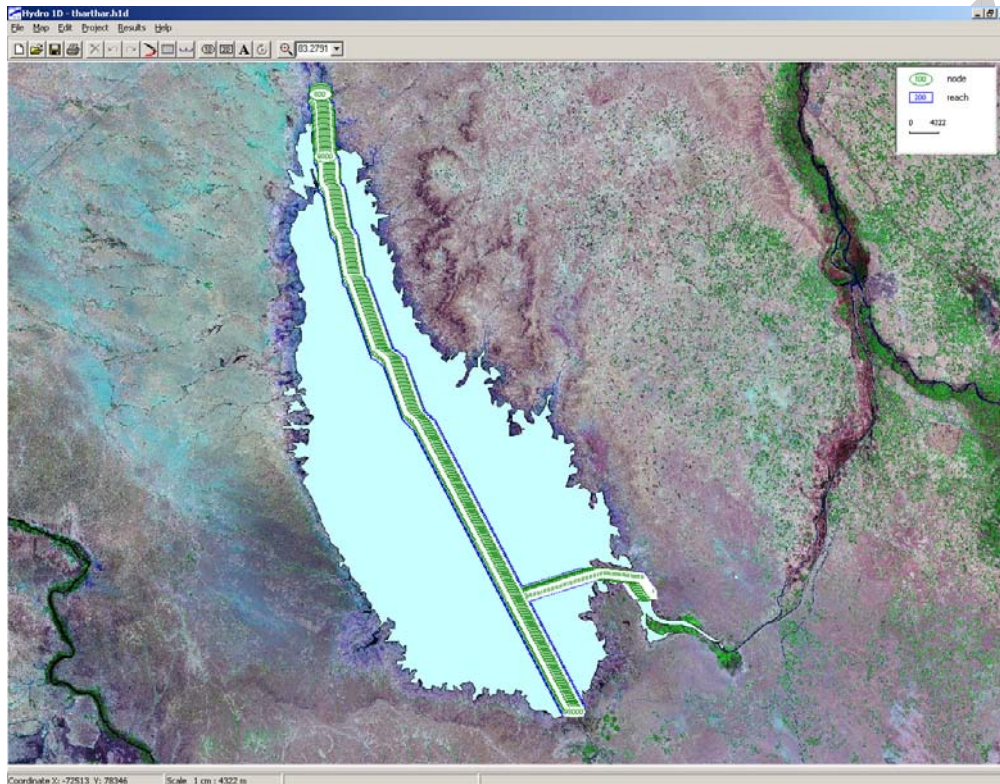
3.4   Model Development for Tigris River

3.4.1   This model is developed for a reach length of 50 km. The network developed for this reach is shown below.

**Figure 3.4: Model Network for Test Reach on Tigris River**

3.4.2   This model has been refined and tested using the best available data. However, the cross-section data for the test version of the model is based on satellite images and spot levels of river bed level. In order to refine and improve this model actual river cross-sections are required for this river reach.

3.4.3   Figure 3.5 shows a screenshot from the pre-processor in HYDRO-1D for the inflow data at the upstream end of the model. The data used was taken from an existing run using the ResSim model for the relevant model node at Baghdad.

Figure 3.5: HYDRO-1D Screenshot showing Inflow data for the Tigris Test Model
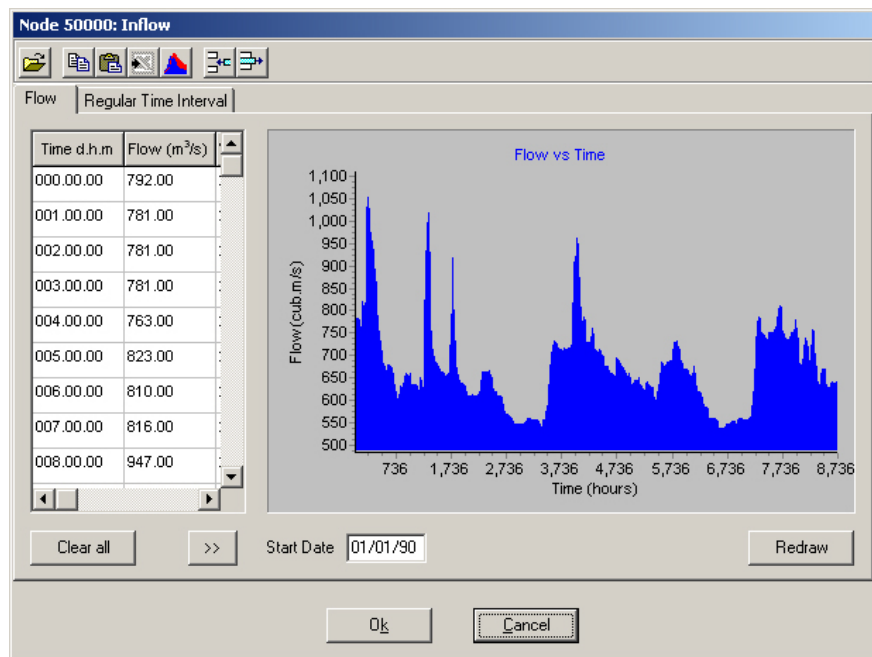
3.4.4 The visual display of the longitudinal profile of the simulated salinity level for this model region is shown in the figure below. The data can also be extracted from the model results file in graphical form or as time series.

Figure 3.6: Example of Longitudinal Profile Plot of Salinity Concentration in the Test Model
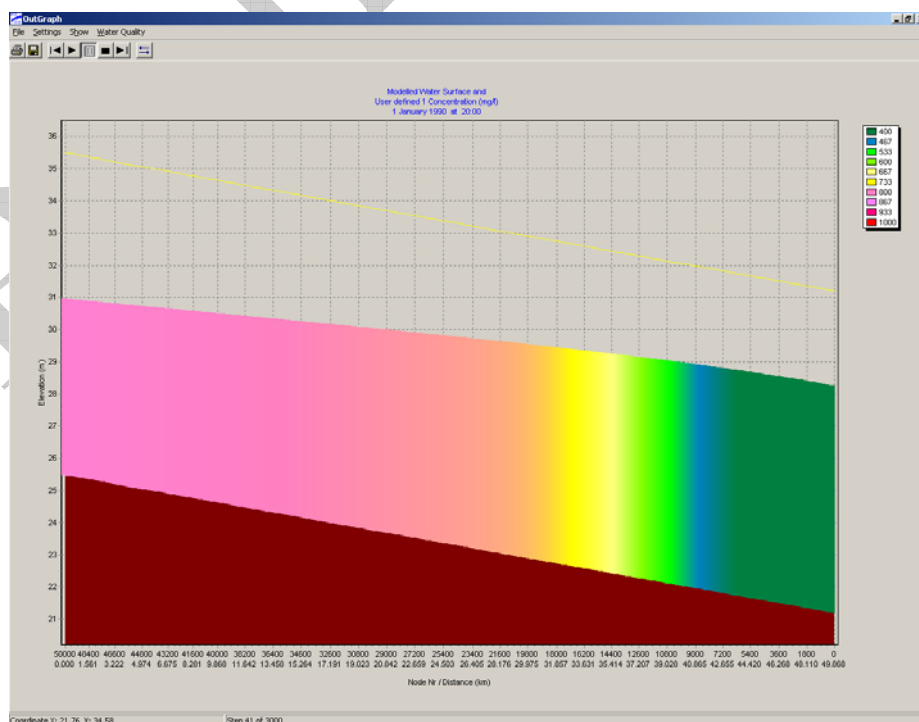
3.5   Lag Coefficients

3.5.1   As discussed above the lag coefficients are dependent on discharges, hydraulic parameters, model resolution and dispersion characteristics of the river system. For these reasons we have attempted to provide a simple approach to standardise these coefficients for the salinity model. In order to achieve these objectives the following factors have been considered:

- Selection of lag times similar to the HEC-ResSim model for the hydraulic component.

- Sensitivity tests on various flow conditions and salinity associated with them to study the variability of lag coefficients.

3.5.2   Based on the studies for the sample areas appropriate lag coefficients have been defined using the HYDRO-1D model. These coefficients have been used in the salinity module of the HEC-ResSim model.

**Table 3.2: Table of Lag Coefficients from Test Model of the River Tigris**

Lag Coefficients							
	C1	C2	C3	C4	C5	C6	C7
Travel Time (days)	*0*	*1*	*2*	*3*	*4*	*5*	*6*
1	0.21	0.79					
2	0.00	0.47	0.53				
3	0.00	0.03	0.78	0.19			
4	0.00	0.01	0.02	0.80	0.17		
5	0.00	0.01	0.01	0.03	0.54	0.41	
6	0.00	0.00	0.00	0.04	0.07	0.27	0.62

3.5.3   A generalised script has been incorporated in HEC-ResSim model to simulate the salinity levels along the Tigris and Euphrates river systems. This is described in the HEC reports given in Volume 3.

4   WATER QUALITY PARAMETERS

4.1.1   The model has options to simulate several water quality parameters which are shown in the menu from the screenshot in Figure 4.1.

Figure 4.1: Water Quality Parameters Available for Simulation in HYDRO-1D
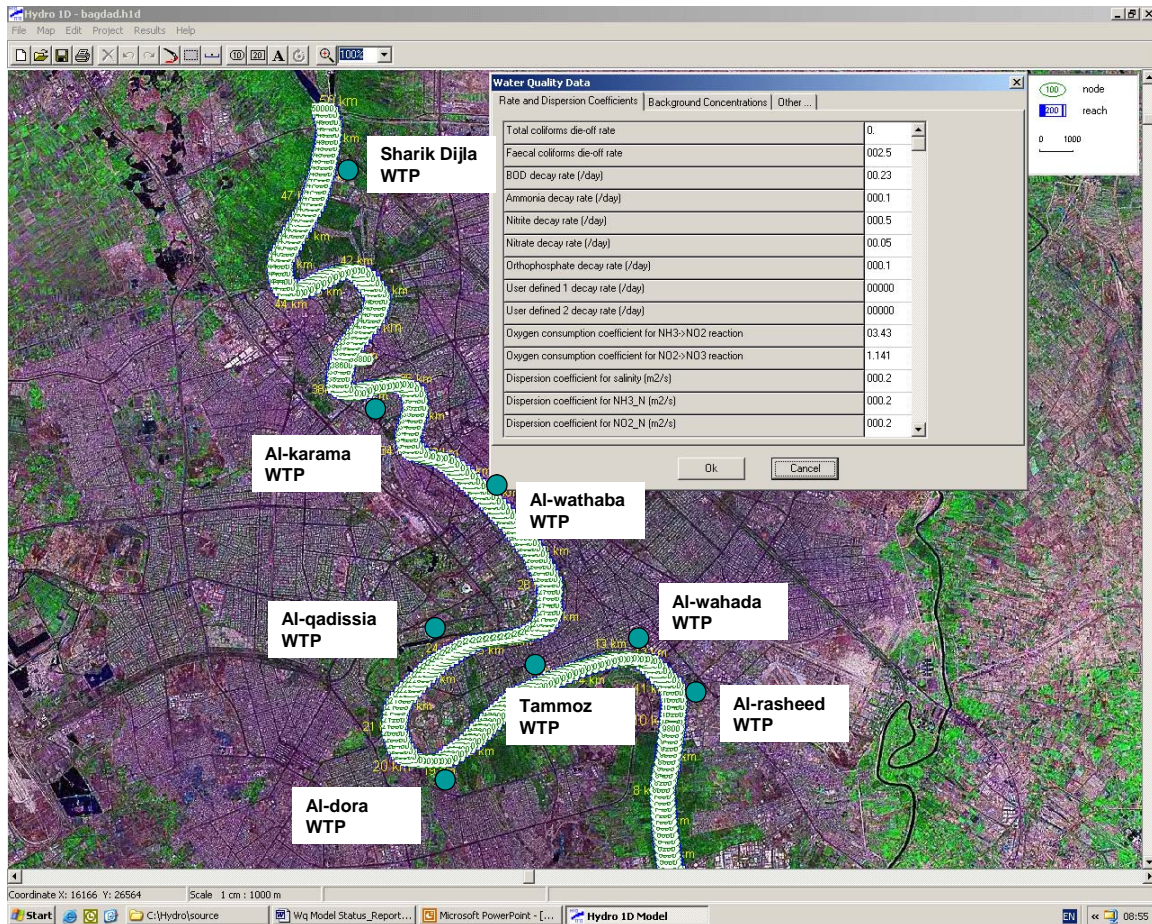
4.1.2   There are several WTP in the model region and the model has potential to assess the impact of effluents entering the rivers from each of these discharge points. The options to assess the BOD and DO levels along the river reaches bring further benefits to assess the level of treatment required from these treatment facilities. Preliminary testing on BOD and DO levels has been carried out to check the performance of the model. However, data collection including monitoring of flows and water quality determinants are pre-requisite to obtain the maximum benefit of the water quality model developed for this region.